TECHNICAL SPECIFICATIONS FOR 0.2s ACCURACY CLASS AC STATIC TRIVECTOR ENERGY METERS, SUITABLE FOR INTER UTILITY METERING AND AVAILABILITY BASED TARIFF APPLICATION

1.0 SCOPE

This specification covers high precision tri vector microprocessor based integrated package 3-phase 4-wire HT Application, 1 Amp or 5 Amp Secondary, metering system with 0.2s accuracy class (for Active and Reactive energy). The offered metering system can be used for energy audit / Load survey and metering for frequency linked ABT tariff as well as applicable to HT/LT consumers tariff purpose.

The offered meter is specifically designed for application of combination of two very different tariffs simultaneously in the same meter. i.e the system will be capable of measuring recording, and storing all required billing/ history / tamper / load survey parameters in Import / Export mode.

We have noted the clause and agree to abide by the same.

2.0 STANDARDS APPLICABLE

The offered meters will conform (for testing, performance and accuracy) in all respects the relevant Indian/International standards with latest amendments thereof unless otherwise specified.

IEC 62053-22: Static watt hour meters- Meteorological specifications for classes— 0.2s and 0.5s.
IS 14697(1999): AC static Transformer operated Watt hour and VAR-hour meters, Class 0.2S and 0.5S specification.
IEC 61036: Static energy meters
IS 9000: Environmental testing
IS 8161: (Draft): Impulse wave testing
IS 13010: AC watt-hour meters of Class 0.5, 1 & 2
IS 12346: Specification for testing equipment for AC energy meters
PFC Spec.: There is no separate standard specification of PFC for such meter/ metering equipment to the best of our knowledge and we are under approved vendor list of PGVCL. How ever our offered meter will meet requirement of relevant standard.
CEA Notification dtd: 17/03/2006 on standard for operation of meters.

The offered metering system matching with requirements of other national or international standard which ensure equal or better performance than the standards mentioned above also be considered.

3. Supply System

System Variations

The offered metering system will be suitable for working with following supply system variations as per relevant clause of IEC 62053-22:

(I) Solid neutral grounded H.V. and E.H.V. 3 phase 4 wire, 50 Hz. system with CTPT (auxiliary transformers) connected.
Primary voltages: 11KV, 22, 33, 66, 132 and 220KV
Secondary voltages: 110/√3 Volts (Phase to neutral); 110V (Phase to Phase)
(a) Primary current: 5 Amps. to 1000 amps. (With standard CT primary ratings)
(b) Secondary current: 5 Amp. or 1 Amp.

In 3 Phase 4 Wire meters 3 nos. 6 wire CT’s will be connected to measure balanced and unbalanced loads from installation charging (i.e. no. load) to 200% of declared lb at all power factors.

4. SYSTEM VARIATIONS:

The electrical quantities required to be measured with a fine degree of precision (The actual supply wave of related voltages and currents would be sampled out at the rate of minimum 3000 samples per second and would provide integrated values of each actual voltage and current cycle monitor, display & store in non volatile memory of high precision static, demand & energy Trivector meters of 0.2s class accuracy for energy audit, load survey and tariff metering purpose at the installation of HT consumers, conforming to latest IEC62053, CBIP Report-88 & IS:14697 and operated through auxiliary transformers, (conventional version of 3 phase, 4 wire Trivector Meter). The offered meters are suitable for working satisfactorily and accurately within the specified limits of error under the following conditions of voltage, frequency, current and temperature.

(a) Electrical Quantities: (i) Voltage:

<table>
<thead>
<tr>
<th>Phase to phase</th>
<th>110 Volts +10% -30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase to neutral</td>
<td>110/√3 Volts +20% -30%</td>
</tr>
</tbody>
</table>

(ii) Currents: 1 or 5A normal (In) and 0.01 in to 1.5 in working.

(iii) Frequency: 50 Hz ± 5%

(b) Range of Temperature variations:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>PARTICULARS</th>
<th>SPECIFIED REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Locations</td>
<td>At various HT connections in the state of Gujarat.</td>
</tr>
<tr>
<td>2</td>
<td>Max. ambient air temperature</td>
<td>55 Deg C</td>
</tr>
<tr>
<td>3</td>
<td>Max. ambient air temperature in closed box</td>
<td>60 to 65 Deg C</td>
</tr>
<tr>
<td>4</td>
<td>Minimum air temperature</td>
<td>6 Deg C</td>
</tr>
<tr>
<td>5</td>
<td>Average daily ambient temperature</td>
<td>30 to 35 Deg C</td>
</tr>
<tr>
<td>6</td>
<td>Max. relative humidity</td>
<td>95%</td>
</tr>
<tr>
<td>7</td>
<td>Max. altitude above mean sea level</td>
<td>1000 meters</td>
</tr>
<tr>
<td>8</td>
<td>Average annual rain fall</td>
<td>700 to 900 mm</td>
</tr>
<tr>
<td>9</td>
<td>Max. wind pressure</td>
<td>200 kg/Sq.mm</td>
</tr>
</tbody>
</table>

MARKING OF METER:

The marking on every meter will be in accordance with IS 14697/ IEC62053-22. The basic marking on the meter name plate will be as follows:
Apex metering system

i) Manufacturer’s name and trade mark
ii) Type Designation
iii) BIS mark – (ISI mark)
iv) Number of phases and wires
v) Serial number
vi) Month & year of manufacture
vii) Reference voltage/ PT ratio
viii) Rated secondary current of CT (-/1 or -/5 A)
ix) Principal unit(s) of measurement
x) Meter constant (impulse/kWh)
xii) Property of _______________

Sampling rate and basic measurement quantities:

We have noted that the electrical quantities are required to be measured with a fine degree of precision (through solid state micro processor, same would have minimum sampling rates of 3000 samples per second for accurate measurement of contents of relevant current and voltage waves) monitor, display and store in non-volatile memory of high precision static demand and energy of 0.2s class accuracy for energy audit, load survey and tariff metering purposes at the installation, conforming to I.E.C-687/ CBIP Report-88 and IS-14697 and operated through auxiliary metering transformers, (conventional version of 3 phase 4 wire Tri vector meter. We have noted that these meters are required to function accurately within the specified limits of errors under the following conditions of voltage, frequency, current and temperature.

The offered meter will have internal Real Time Clock with the back up of a Lithium maintenance free battery of minimum shelf life of Ten (10) years for operation of the time clock. The Real Time Clock will be based on Quartz crystal timer to make it independent of line frequency variations.

6. QUANTITIES TO BE MEASURED, MONITORED AND MEMORISED:

[A] The meters will be capable of measuring and storing in the memory, and displaying following electrical quantities on summator controller (in case of multiple meter) within specified limits of error for poly phase supplies (i.e. 3- phase, 4 wire system with star point (neutral) solidly grounded or floated) of 3 phase Delta or Star connected load having a floating or a grounded Star point with balanced or unbalanced loads at all power factors. The apparent demand & energy is derive from active energy cosine part recording arrangement) & reactive energy (sine part lagging power factor recording arrangement) trough vector summation of active energy and only lagging reactive energy transwars for 15 min integration period and billing period.

The offered meter is capable of measure/ store 4 TOD time zones for prespecified periods of the day and the meter’s memory capacity shall be 35 Days for 15 Min IP

[B] Memory of the meter:

The offered meter will keep following quantities recorded for each 15 Min successive integration block and memorized in its Non Volatile memory chip, so that in event of failure/damage of the meter the last reading of billing quantities would not be lost.

1. Cumulative Total Active energy Import .
2. Cumulative Total Active energy Export
3. Average system frequency
4. Cumulative KVARH lag while KWh import.
5. Cumulative KVARH lead while KWh import
6. Cumulative KVARH lag while KWh export.
7. Cumulative KVARH lead while KWh export.

[C] General measurement requirements:

① The meters will be suitable for being connected directly through its terminal block. The metering system will draw functional power through AC auxiliary power supply their by avoiding burden to the metering. In event of failure of auxiliary supply, it will automatically change over to VT supply.

② Meters will be suitable for working under balanced / unbalanced loads at all power factor i.e. Zero lag-Unity-Zero lead. The display will indicate direct values without having to apply any multiplying factor.

③ The meter will compute the average frequency of the previous 15 minute block in Hz.

④ The offered meter will count the number of cycles in VT output during each successive 15 minute block and divide the same by 900 (when supply voltages are present) to arrive at the average frequency

⑤ The meter will also compute the reactive power on 3-phase, 4-wire principle, with an accuracy as per relevant standards, and integrate the reactive energy algebraically into two separate registers, one for the period for which the average RMS voltage is greater than 103%, and the other for the period for which the average RMS voltage is below 97.0%. When lagging reactive power is being sent out from substations bus bars, reactive registers will move forward. When reactive power flow is in the reverse direction, reactive registers will move backwards. The reactive energy will also be stored in four different registers of meter memory as Reactive import while active import, Reactive import while active export, Reactive export while active import, Reactive export while active export. Cumulative energy registers of the same shall be made available on display and on BCS.

⑥ The meter will also store the apparent energy (Import/ Export) and cumulative energy registers of the same will be made available on display as well as on BCS. All apparent energy and demand specified under this specs are computed from total active energy and reactive lag energy separately from Import and Export mode.

⑦ The meters will be compatible with ABT as well as TOD tariff. For TOD 4 time zone can be configured

⑧ The meters will be able to measure and display parameters like instantaneous phase wise voltages, instantaneous line currents and instantaneous average three phase power factor. And time

⑨ Each meter will have a test output device (visual) for checking the accuracy of active energy measurement. Further, it will be possible to switch over the same test output device to reactive energy via suitable means

⑩ The display will be of dot matrix format Alpha numeric LCD type with back-lit and key pad type. Display will be individual/ common for all the meters housed in a rack and necessary means will be provided for moving forward/ backward from one display to the other.

⑪ The offered metering system will normally operate with the power drawn through the auxiliary power supply. An automatic backup for continued operation of the meter’s
Apex metering system

The calendar-clock, and for retaining all data stored in its memory, will be provided through a long life battery, which will be capable of supplying the required power for at least two years. The meters will be supplied duly fitted with the batteries, which will not require to be changed for at least ten years, as long as total VT supply interruption does not exceed two years.

The design enables the auxiliary supply to be switched automatically between the AC and DC voltage, depending upon which is available. Typically auxiliary voltages available are 110V AC and 110 / 220V DC to power up the unit. The system will continue to work even if any one of the above (AC/DC) is present. In Secure make Apex ABT meter no data loss occurred during supply off condition. Further supply failure events shall also logged in meter. In Apex meter there is no supply change over for AC/DC aux. and CT/PT supply.

Each meter will have a built in calendar and clock, having an accuracy of 1 minute per month or better. The calendar and clock will be correctly set at the manufacturer’s works. Clock adjustment will be possible at site using MRI.

The offered meters will safely withstand the usual fluctuations arising during faults etc. In particular, VT secondary voltage 115% of rated voltage applied continuously and 190% of rated voltage applied for 3.0 seconds, and 30 times of rated applied for 0.5 seconds will not cause any damage to or mal-operation of the meters. The immunity to external magnetic field will be strictly as per latest CBIP recommendations. However for reactive power and reactive energy measurement, limits of errors for both active as well as reactive energy in all the four quadrants will be in accordance to IEC 62053-22. Errors will comply with CBIP recommendations for all power factor angles from 0 to 360 degrees.

The offered meters will continue to function, as specified above, in case of failure of one or two phase of PT supply. In case of a complete VT supply failure, the computation of average frequency (as per clause 5.0) will be done only for the period during which the VT supply was available in the 15 minute block.

**DISPLAY**

The display of metering system would be dot matrix alpha numeric LCD display with 4 lines of each 20 characters with back-lit. The display would read in a temperature range of –20 °C to +55 °C. The data recorded by the meters would be continuously stored on EEPROM, thus being able to retain the data in case of power failure without the aid of batteries. Each of the physical quantity shall remain on display screen for 7 sec. Following quantity shall be displayed continuously in a specific cyclic order with a gap of 2-3 min.

1. LCD segment check
2. Instantaneous per phase Voltages (R,Y,B)
3. Instantaneous per phase Current (R,Y,B)
4. Instantaneous Line frequency
5. Phase Sequence of voltages
6. Instantaneous Total Active Power KW (Import/ export)
7. Instantaneous power factor
8. Real Time
9. Date
10. Raising demand in KVA – Export/ Import with elapsed time
11. Cumulative (24 Hrs) Total active energy import
12. Cumulative (24 Hrs Total active energy export
13. Cumulative (24 Hrs reactive energy lag while active import
14. Cumulative (24 Hrs reactive energy lead while active import
15. Cumulative (24 Hrs reactive energy lag while active export
16. Cumulative (24 Hrs reactive energy lead while active export
17. Cumulative (24 Hrs apparent energy while active import
18. Cumulative (24 Hrs apparent energy while active export
19. TOD (time of day) KWh Export – Peak, Rest, Night
20. TOD KVARh (lag while KWh export) – Peak, Night, Day – On BCS
21. Present KVA Maximum demand import / Export – 24 Hrs
22. Last month KVA Maximum demand import / Export – 24 Hrs (between last two resets)
23. Maximum demand Apparent export for current month (TOD wise)
24. No of MD reset Count
25. Last 15 minutes block average frequency
26. Last 15 minutes block average of the KWh energy import
27. Last 15 minutes block average of the KWh energy export
28. Cumulative Reactive energy for the voltage high condition (ie. when RMS voltage > 103%Vn)
29. Cumulative Reactive energy for voltage low condition (ie. when RMS voltage < 97%Vn)
30. Tamper data Information -
31. Present anomaly status
32. Date of first occurrence of anomaly
33. Time of first occurrence of anomaly
34. Time of last restoration of anomaly
35. Date of last restoration of anomaly
36. Total anomaly count
37. Cumulative Fundamental KWh – Export – on BCS
38. Cumulative Total KWh – Import –
39. Cumulative Fundamental KWh – Export – on BCS
40. Covered in 19.
41. Cumulative KVArh – Import/ export – Peak, Night, Rest – on BCS
42. TOD History -1 KVA MD Import/ export (last billing period) Peak, Night, Rest
43. TOD Current KVA MD Import/ export (current billing period) Peak, Night, Rest
44. Meter CT/ PT ratio
45. Total Power ON hrs.
46. Meter Constant i.e pulse/KWh & KVArh

A key pad is provided on the meter front for switching the display and for changing from one indication to the next.

Communication instruction storing capability:

The Offered metering system will have multiple communication ports for local reading and remote communication facility.

Each meter has an optical Galvanically isolated communication port compatible to RS232 on its front for tapping all the data stored in its memory. Meter reading instrument (MRI) will be provided for this purpose, as per the requirement so as to serve as interface between the meters specified above and the PC loaded with Base Computer Software. The offered metering system will be compatible to GSM network remote data transfer to a central location. Following parameters can be change after due authentication and protected password.
Apex metering system

1. Change in integration period
2. Change in automatic MD reset date and time
3. Modification in TOD timing

Additionally, the offered metering system will provide a communication port compatible to RS-232 port for online data transfer to a central location (optional). This port will be capable of data transfer to a main computer on real time basis using suitable communication network (VSAT/ Leased line/ OFC) via compatible hardware (interfacing equipment/ communication cables etc. as required).

Maximum Demand registration

The offered meter monitor the demand during each integration period and set the register value, the raising demand under the current IP will be displayed with elapsed time. The integration period can be adjusted to 15 Min. to suit tariff requirements. The IP can be changed to 30/60 Min. which can be set through proper authentication system using MRI

Note- We have noted the content of this clause.

Maximum Demand reset:

The offered metering system has three options to set the MD

1. The MD will be reset automatically on a pre defined date and time
2. Through Authenticated MRI system
3. We are providing manual MD reset facility with adequate sealing arrangement.

Energy audit and Load survey capabilities:

Each meter will have a non-volatile memory in which the parameters following will be automatically stored for each successive 15 minute block these parameters will be available for last 35 days. The load survey data will be available in the form of bar charts as well as in spreadsheets after down loading the data in to our analysis software (being supplied along with the material) . The BCS will have the facility to give complete time synchronized load survey data both in numeric and graphic form. Following parameters will be stored in the NVM. Further it is difficult to categories time taken to read different parameters set though you may have reading of full load survey within 22-27 min. via GSM & MRI operation. This will include all meter reading though practically it may differ.

1. Fixed parameter
   a. Meter make and sr. no.
   b. Prevailing integration period
   c. Automatic resetting date and time
   d. Meter constant i.e no of P/O per unit OR o of unit /pulse.

2. Variable parameters / information
   (a) Active energy: Total (Fundamental plus Harmonics) Kwh/Mwh Export and Import. (For last and current billing period)
   (b) Reactive energy: KVARh / MVARh lagging and leading with respect to import and export of energy. i.e. Reactive Lag while active import, Reactive lead while active import, reactive lag while active export and reactive lead while active export. ( for last and current billing period)
   (C) Apparent energy KVAh /MVAh Import or export derived vectorically from lagging reactive and Total Active energy (I) for last billing period & II for current billing period

   • Active energy import
   • Active energy export
   • Average frequency
• Average load active import
• Average load active export
• Average system voltage

The offered metering module will also store the midnight values for 35 days of the following electrical parameters:

• Reactive energy for voltage low condition
• Reactive energy for voltage high condition

Billing parameters: The metering modules will store following parameters corresponding to defined bill dates for up to last three months:

• Active energy import
• Active energy export
• Reactive high energy register
• Reactive low energy register
• Maximum Demand Apparent Import

Maximum demand Apparent Export the offered metering system logs following parameters for each 15 min. Ip for the last 35 Days.

The load survey data for 15-minute average of the above parameters will be available for last 35 days. The load survey data will be available in the form of bar charts as well as in spreadsheets. The BCS will have the facility to give complete time synchronized load survey data both in numeric and graphic form. The recording of Load survey is FIFO basic. The offered meter is capable to store 100 No tamper in it.

The s/w (BCS) will also give summary report of all the tamper events with total duration (for each type) for event occurred / restoration from the date of installation.

It will be possible to retrieve all these data via communication port on a HHU (MRI) & will be possible to off load these data on to IBM compatible computer and get complete details of the load in numerical data and in graphical form for all 24 Hrs. a day divided as per pre set IP of 15 min. The necessary s/w (SMART2000) is being provided for the same. Further It is difficult to categories time taken for different parameters set. Though you may have reading of energy parameters within 6-7 min. via GSM & MRI operation.

Time of Day (TOD) tariff / demand

The offered metering system is capable to register demand and energy consumption for 8 time zones in 24 Hrs cycle to record time of day consumption. It will be possible to change this TOD through authenticated (protected password) CMRI, duly programmed on BCS s/w supplied by us.

Harmonic measurement

The offered meter is capable to measure 50 Hz.( pure sine wave) and total energy i.e ( 50 Hz + harmonics)

Data transfer and meter reading instrument

The offered meter reading instrument is compact and portable with (rechargeable battery powered. This MRI will be capable to cover data from various energy meters and transfer them in minimum time on an IBM compatible computer. The computer s/w will detail information on billing, energy audit and load survey.

Construction of the meter

The offered meter is adequately shielded from adverse effect of external AC & DC magnetic field. The offered meter confirm to IP51 degree of protection. The offered metering modules will be draw out type with automatic CT shorting feature so as to ease the testing/ replacement of meters without disturbing the system. The offered meters will also withstand without any damage or mal operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. The offered meter would not get damaged or influenced by the any of EMI & EMC as per defined in IS14697.
Sealing of the meter module:

Proper sealing arrangement has been provided for the following: Two nos. sealing arrangement are provided on the meter cover. Sealing arrangement is accessible from the front side only. Provisions are available to seal the back connections on the metering system using the terminal cover.

The sealing arrangement is suitable for application of Polycarbonate seals.

Tamper and fraud protection / information,

The meter will have features to detect the occurrence and restoration of, at least, the following common anomaly:

1. **Potential phase sequence** - The offered meter shall measure/monitor phase rotation and store all variable electrical quantities (active and reactive both) irrespective of rotation of potential phase sequence (i.e. either clockwise or anticlockwise) accurately within the specified limits of errors.

2. **Phase-wise missing potential** – Indication of missing of voltages and/or partial potential reflected due to missing of primary potentials i.e. difference more then 30% between phase to phase (line) potential with date, time and duration stamped specifying appropriate phase affected.

3. **Line Currents**: (I) Indication of missing and/or (II) bye-passing i.e. different more than 20% in magnitude between relevant phase currents with date, time and duration stamped specifying appropriate phase affected.

4. **Temperature Sensor**: The temperature sensor should be provided in physical form of assessment i.e. temperature indicating stickers to sense highest temperature of meter.

5. **Phase wise current circuit reversal** - meter will detect reversal of polarity provided the current terminals are reversed. This will be recorded for 1 or 2 phase CT reversal.

6. **Voltage unbalance** – meter will detect voltage unbalance if there is unbalance in voltages. The deviation from the phase with highest voltage will be used to detect an unbalance in voltage.

7. **Current unbalance** – meter will detect current unbalance if there is unbalance in load conditions. Meter should ensure true system conditions before going for current unbalance checks. These conditions Include voltage unbalance and average line current below a specified threshold.

In addition the offered meter shall record and snapshots of phase wise voltage, active current and power factor as well as date and time of logging of occurrence and restoration of all the above anomaly events will be logged into the meter memory.

8. **Power on/off** – meter will detect power off if both the auxiliary supplies fail. The event will be recorded on the next power up. At the same time power on event will be recorded. No snapshot will be logged with this event.

9. **Feeder Supply fail** -This event will be logged when feeder supply, i.e. all the voltages goes below certain threshold. Event will be restored when any of the voltage goes above certain threshold. No snapshot will be logged with this event.

Last hundred (occurrence + restoration) such events in total with date and time will be stored in the meter memory on first in first out basis. There will be four separate compartments for logging of different type of anomalies as follows:
Compartment No.1: 20 events of missing potential
Compartment No.2: 20 events of CT polarity reversal
Compartment No. 3: 40 events for voltage and current unbalance
Compartment No.4: 20 events of feeder fail and power On/Off

The logging of various anomalies in each compartment will be as under:

Once one or more compartments have become full, the last anomaly event pertaining to the same compartment will be entered and the earliest (first one) anomaly event should disappear. Thus, in this manner each succeeding anomaly event will replace the earliest recorded event, compartment wise. Events of one compartment/category should overwrite the events of their own compartment/category only.

Anomaly count should increase as per occurrence (not restoration) of anomaly events. Total no. of counts will be provided on BCS.

Accuracy:

Class of accuracy of the metering system will be 0.2s. for active and reactive power and energy measurement and will follow IEC62052-22 / IS 14997 latest amendment for 0.2s and 0.5s class The accuracy will not drift with time. The tests and reference conditions under which tests shall be carried out shall be in accordance with respective clause no. of IEC 62053-22 along with tests and test conditions as envisaged under respective clause no. of IEC 62053-22.

Additionally - To compensate the CT/PT errors, each meter has the facility to program errors of external measurement transformers through its optical communication port: These are

i. Linear compensation to enable the measurement PT errors (ratio and phase) compensation; there will be linear adjustment which will be applied across the complete measurement range of the transformer.

ii. Non-linear compensation to enable the measurement CT errors (ratio and phase) compensation; this will allow multiple ratio and phase adjustments to be applied for different load points per phase input of the meter.

VA Burden of various circuits:

iii. Voltage Circuit: The active and apparent power consumption in each voltage circuit including the power supply of metering module at reference voltage, reference temperature and reference frequency will not exceed 1 Watt per phase and 0.5 VA per phase respectively.

iv. Current Circuit: The apparent power taken by each current circuit at basic current, reference frequency and reference temperature will not exceed 1 VA per phase.

v. The meter will be operating on auxiliary power supply

Software (BCS - SMART2000)

1. Window based s/w (SMART2000) is will be supplied to off load the MRI
2. The above s/w will have capability to communicate with the offered meters through optical communication port (RS 232) for down loading all the data from meter to PC.
3. The offered meter can also be able to communicate directly with the LAPTOP computer.
4. The s/w will also have capability to remotely communicate on GSM modem
5. The offered s/w will create ASCII file as per DISCOM’s format for billing purpose.

Technical evaluation
6. Type test certificate – Required type test certificate as per relevant stand for -/1 Amp conducted with 3 years Are available and can be submitted as and when required
7. We are original manufacturer, and have been supplying these meters since last more then 18 years to various electricity board/ utility in India and overseas..
SPECIFICATION FOR REMOTE METERING SYSTEM

INTRODUCTION:

We have noted the contents of the clause.

Scope of supply:
The required system will comprise of following:

1. HT Tri-vector meters (CMU)
2. External GSM MODEM each to be supplied at:
   - Consumer meter unit
   - Master Information Centre (MIC) – Located at respective Corporate Office.
   - Divisional Information Centers (DIC) – Located at respective Division Offices.
   - Consumer Meter Unit – Located at Consumer’s Premises All the meter will have Optical port in addition to RS232 serial port for connection of external MODEM for communication system.

The offered SMART2000 s/w with store and forward dialing facility is already installed at various places with your esteemed organization for the purpose of dial and get the reading from the meter connected on GSM network through ECD200 Modem.

The AMR system will be able to do following task.

(i) Down load all relevant data from the meter (CMU) installed at consumer premises.
(ii) Transform the data into signals suitable for transmission through the selected communication Media – GSM.
(iii) Transmit it to the above information centers of DISCOM’S.
(iv) Transform the data into ASCII format suitable for report generation, invoicing control from the Computer system at any of above information centers. Also will transform the data into a ASCII format suitable for management information, load monitoring, load surveying, evaluation of tamper attempts etc.

1. SCOPE:-
As per the scope we understand that the only the AMC of AMR system is in our scope of work. We also understand that the installation and commissioning of meter, GSM modem, meter box and TTB is not in our scope & the same will be installed by DISCOM’S. However, we will be providing the 5 years of AMC for AMR system only after the installation of whole system.

We have installed about 3000 No such system in GEB’s various DISCOM,

2. GENERAL REQUIREMENTS:

(i) The system will have security features to prevent any access by unauthorized personnel to the data, hardware & software.
(ii) The system will have security features for restricting unauthorized personnel from performing activities which are not within their authorization.
(iii) The communication links between CMU & dialing information centers will be fully encrypted as per relevant Data Encryption Standards (DES).
(iv) Security of Data in transit will be provided by using standard protocols. Error detection and correction protocols & security measures.
(v) Supply of data cables with 9 pin connectors connecting meter to modems for all CMU which is compatible & suitable with existing meter’s communication port(s),
Apex metering system

Data cables connecting base computers and modems at MIC / SMIC / CIC / DIC suitable with RS232 port, power units for modems if required, connectors and all other accessories/parts required to download relevant data from all CMU to MIC / SMIC / CIC / DIC by successful establishing remote connection through GSM media. Supply of all such accessories/parts which are useful and necessary for its electrical, electronics and mechanical safe operation deemed to be within the scope of this order.

(vi) The system will be able to work under the following environmental conditions:

a) Temperature : -20 degree C to 65 degree C.
b) Relative Humidity : 2 * Rh to 95% RH Non Condensing
c) System : Voltage 3 x 63.5V / 3 x 110V.
d) System Frequency : 50 Hz + 5%
e) Influence Quantities : CBIP-88 (Revised July-96) & IS-14697.

(vii) The system will have adequate redundancy & archival capabilities.

3. **Consumer Meter Unit (CMU):**

Please refer the technical offer for the energy meter.

4. **Communication Interface:**

- The remote communication will be over RS232 interface.
- We will supply updated latest version of software at all information centre base computers, Windows based necessary Software with necessary drivers will be installed at all MIC / SMIC / CIC / DIC as said above with necessary driver(s) if necessary which can successfully download all relevant data available at consumer meter (CMU) remotely without any software and hardware conflicts. Software will include additional features of ASCII conversion The data will be available in ASCII format which can be used with any third party software or with existing HT billing software and as per requirement of future e-Urja system also. Software will be compatible and will support communication with all version and all manufacturing years’ meters of our company (Secure make) supplied from very beginning.
- The Base Computer Software (BCS) in case of Data collection centers described as above will be featured for Auto Scheduling for polling and interrogation of any data from the CMU automatically at pre defined/required time of the day (i.e. Programmable)
  - Collect data as per time interval defined by the user. The user can change the interval as and when required.
  - Collect data from energy meter using optical port or RS232 of the meter.
  - The user can also send query to the box and collect the necessary data.
  - The data collected would be encrypted so that no external interference can affect the security of the data. The manipulation with the data collection is not possible.

5. **MODEMS:**

The Modem will be used at the consumer meter terminals and at the DISCOM’s dialing Information Centers for transforming the signal and transmitting through the selected medium. A standard Hayes compatible Modem will be used for communication. The
Modem will:

(i) Have connector interface to RS232.
(ii) Work in dial up/polling mode.
(iii) Have auto dial/polling, redial, dial linking, call status display, auto parity and data rate selection through the BCS.
(iv) Support serial binary and asynchronous data format for data transfer.
(v) Have a facility of error correction as per Microcom Network Protocol (MNP).
(vi) Not be susceptible to electromagnetic and other interference from nearby monitors and power supplies as per IS:13779
(vii) Have data compression facility as per MNP or CCIT standard.
(viii) The offered modem does not require any command buffer.
(ix) Have High Brightness LED indication for transmitting data, receiving data, off hook etc.
(x) Have adjustable data rate.
(xi) The offered modem will be installed inside the meter box. There will be provision of minimum 2 (Two) seals to be provided on case of modem. Modem will be installed in Metal Meter Box (MMB) and an external antenna thereof also will be installed outside the MMB to get the best connectivity. We have noted that sealing facility at optical port side will be preferable.

SPECIFICATIONS AND SALIENT FEATURES OF MODEM:

- Automatic wide supply voltage range 77V AC–310V, 50Hz AC.
- Non-Transparent data transmission at 1200/2400/4800/9600 bps selectable.
- Ability to operate with the offered meter and to remote station via GSM network.
- Cellular Network type: Dual band EGSM 900/1800 MHz
- Serial Baud Rate 300 to 115200 bits/s.
- Compliant with ETSI GSM Phase 2+ standard.
- Power Output: 2Watt
- Remote control by AT commands (as per GSM 07.07 & 07.05).
- SMS/Data/Internet compatible.
- GPRS class 2 OR class 10 supports.
- Auto dial feature.
- Using GSM system for wireless communication.
- Operating temperature: -20 degree C to 65 degree C.
- Relative humidity: 95%.
- Dust/Moisture resistance: As per IP50.
- Enclosure: High grade Engg. Plastic with IP50 compliant and EMI/EMC tested.
- Connection with consumer meter: Compatible with Optical port.
- Network Interface: SMA – female Antenna connection.
- Interference Immunity: IS13779, High immunity to noise.
- Lightening withstand 6kV and high resistance to lightening.
- Power consumption: Not more than 3 VA under idle condition and not more than 6 VA during data transfer.
- Cellular Data Service: Radio link protocol.
- Data SIM card: Removal data SIM card.
- External high gain antenna of 5.5 dbi, magnetic mounted will provided to be mouted outside the meter box for better connectivity.
- LED indicator for Network availability, carrier, serial Tx/Rx via single LED.
- Baud rate of the modem would be changeable. It would work on 300 to 115200 bits/sec. However it would be noted that typically modem works on minimum 9600 baud rate. In
order to make optimum use higher baud rate will be preferred. The low baud rate may result in loss or hanging/hampering of retrieved information. The product being offered would work on the fastest speed of even 115200 bps also.

**Base Computer Software (BCS – SMART 2000):**
Latest updated version of Windows based software with necessary drivers will be provided. The data from various sites can be collected manually or automatically at information centre on a PC/server. The PC/server will have GSM connectivity and it will collect data from various meters.

**FEATURES OF DATA COLLECTING SOFTWARE:**

1. **Data collection:**
   a. The software would have facility to dial a particular meter or group of meters and collect data as and when required by user from base computer. The user can also set a time at which it would dial and collect data of any individual consumer or group of consumers as per time schedule set by user in the software.
   b. The user can collect all data or specific data from the meter.
   c. The data collected can be evaluated for analysis of load pattern, tamper attempts / events or other consumer related activities.

2. **Reports**
   a. Reports would be generated as per the requirement of DISCOM’S. We will mutually discuss and agreed upon the formats and specifications for the required reports at the time of placing the order.
   b. The software would be user friendly and would be menu driven. It would be easy to generate reports and to get any consumer information.
   c. It would have in-built facility to export data to MS-Excel format.

3. **SIM card specifications:**

   We have noted the clause, however may please ensure that the configuration of data SIM card should be as under.

   The data communication enabled SIM card shall have following configuration

   - **SIM interface:** 3 Volt
   - **Data enabled:** Out going as well as incoming
   - **Mode:** Non Transparent
   - **Connection:** Circuit switch
   - **Data format:** 8 data bit, NO parity, 1- stop bit

   DISCOM’S will provide SIM cards for Modem and also for receiver at control station. These SIM cards would be of standard sizes that are used in GSM mobile phones. SIM card would operate on 5V / 10V.
PART – III
DIFFERENTIAL DATA SUMMATION UNIT:

A dedicated, numeric summation unit shall be provided that would collect the incremental data from the feeder meters. There can be maximum of four feeder meters in a typical installation. The incremental data used for transmission to the summator will be in numeric format for highest resolution and the data should have the details of full four quadrant increments. This summation module will process the digital output data of each feeder to provide the concurrent demand and other resultant outputs as specified below:

The data summation module shall be capable for processing the meter reading for billing. The required quantities for billing shall be as per normal HT tariff and ABT tariff.

- Cumulative summated kWh (Import/Export)
- Cumulative summated kVArh (lag and lead with respect to Import/Export)
- Cumulative summated kVAh (Import/Export)
- Cumulative summated kWh in different rates (Imports/Exports)
- Cumulative summated kVArh in different rates (lag and lead with respect to Import/Export).
- Cumulative summated kVAh in different rates (Import/Export)
- Summated reactive lag energy while active import
- Summated reactive lead energy while active import
- Summated reactive lag energy while active export
- Summated reactive lead energy while active export
- kW or kVA in different rates (Import/Export)
- KW/MW demand for 15 minutes in Export AND Import mode and Arithmetic sum of KVA max demand. i.e. KVA1 + KVA2 + KVA3…..for 15 minutes integration period in Export and Import mode.

NET PROCESSING

NOT APPLICABLE as this metering system shall be used for separate Import and Export metering hence net processing is not applicable in this case however the system can be configured for either net processing or arithmetic summation whichever is applicable.

The offered equipment can be used(after reconfiguration at our works) for network having the possibility of Wheeling of electricity can have the facility to measure the NET Import or Export continuously and based on the sign (Import / Export) of the transaction, will compute other derived registers. The metering system will be skilled to derive / compute NET energy / demand values as per programming. e.g. kVAh AND KVA CALCULATION:

The offered Summation unit shall calculate the Concurrent real time arithmetical sum of individual KVA maximum demand, i.e. KVA1 + KVA2 + KVA3 + KVA4 etc. And the KVA1, KVA2... shall be vectorial summation of Kwh and Only Lagging KVARh. The total kVAh (or concurrent NET kVAh Import / Export) quantity from the incremental feeder meter readings like KVAh1 + KVAh2 + KVAh3 etc.

The accuracy of the calculated kVAh will be of 0.2% over the full power factor range. It is therefore the modules offered here with this will be class 0.2S kWh and 0.2S kVARh meters are used as feeder meters on each of the line.
The Concurrent demand will be computed on the fixed time block principle. The block interval shall be 15 Min IP. However programmable to required DIP intervals.

DISPLAY OF MEASUREMENT

The Summation unit shall measure and display the following quantities:

- Summator identification
- Current time
- Current date
- Cumulative Summated kWh (Import/Export)
- Cumulative Summated kVAh (Import/Export)
- Cumulative Summated kWh in different rates (Imports/Exports)
- Cumulative Summated kVAh in different rates (Import/Export)
- Cumulative Summated kVAh in different rates (Import/Export)
- Cumulative Reactive energy for voltage high condition
- Cumulative Reactive energy for voltage low condition
- Average Frequency

DATA COMMUNICATION AND POWER SUPPLY:

1. Each meter and Summator shall have a service serial communication port for data collection and programming. The interface of the serial port should be RS-232 interface for connection to the portable personal computer. The service serial communication port shall be located at the front panel of the Summation unit and protected by sealable cover against the ingress of dust, moisture and unauthorized access.

2. The summation unit shall draw its operating power from the Auxiliary power supply. There should be two distinct auxiliary supplies, one over AC 110 Volts and the other over DC 220 or 110 Volts so that the metering system remains alive even if one or more feeder(s) is shutdown. The maximum VA burden of the Summation unit should not exceed 10 VA.

3. For remote data collection, the Summation unit shall have a modem which is suitable for the connection to GSM or PSTN System.

4. Each of the metering modules and summation unit should have an independent communication port for electronically communicating the recorded data to the outside world. Such communication will be termed as “remote local”. This communication port will be optically isolated type and we will provide appropriate data retrieval accessories.

5. The single modem will provide remote access to all the metering modules fitted on the main and check metering racks. The maximum number of metering module may be eight.

6. We agree to supply modem for the Central Computer:- However it is already supplied and installed at every sub division office for remote meter reading.
PROGRAMMING OF SUMMATION UNIT:

The Summation unit is factory programmable. A service Software tool can do so through the service serial communication port. The software for programming is highly protected by a Multi layer security password, such that programming such only is granted after the correct input of password. – We have noted the policy matter.

DATA RETENTION AND REGISTRATION:

- All programmed data and registers will be stored in memory, which will be non-volatile type for data retention of not less than ten years.
- End of the demand period data shall be written to the memory at the end of each integrating period.

RTC AND CALENDAR:

Energy meters and summation unit will be provided with ancillaries having features indicated below. The clock shall use the notation HH:MM:SS to 23:59. The calendar will be correct for at least fifty years and will automatically cater for leap years. The clock time of the Summation unit could be synchronized by the time of the Central Computer and the summation unit clock should be used as the master clock for its feeder meters.

The clock shall have the accuracy level better than +/-1 second per day over the operating temperature range from 0 to 45 deg C.

The summator is programmed in such a way that it will perform all it’s routine activities automatically like switching of various tariffs, automatic maximum demand reset, end of billing period and load curves. Synchronization of time will be possible from an external source like the STSF (GPS time synchronization) using a personal computer. May please mention in the PO if such system is required

The internal clock shall feature 24 hours display with all consideration of a perpetual calendar.
7. Real time clock shall be quartz controlled, backed up by a lithium battery.

LOAD CURVE RECORDER:

1. Provision is made for continuous recording of load profile in the bulk memory, which is an integral part of each meter and summation meter.
2. The integration period for the load curve shall be selectable from 15, 30 and 60 minutes.(for ABT it is 15 Min.)
3. The load profile parameters will be for MW-Import, MW-Export, MVAr-lag, MVAr lead, MVA. 45 days data for each 15 minute average of the stated parameters is stored.

SOFTWARE:

Necessary software for operation of the central station shall be supplied and installed on the PC. This will be called as “Base Computer Software”.

The BCS software shall have at least the following facilities/features:
i. It will allow the configuration.

ii. It will be possible to download all the data from the metering module and summation unit either by CMRI / lap top or remote reading system.

iii. It will be possible to view and analyze the data at PC end and hard copies of various reports can be obtained for reference.

iv. It will be possible to read the data received from the meter.

v. It will be possible to export the data to spread sheet programs for detailed analysis and billing.

vi. It will include appropriate security levels for control inputs and data output so that unauthorized person must not have access to part of the system leading to any intentional or unintentional disturbance in the working of the system and the stored data.
STANDARDS FOR METER READING INSTRUMENT

The Meter Reading Instrument (CMRI) will conform in all respects to the following standards:

CBIP Technical Report No. 111 - Specification for Common Meter Reading Instrument. (Read with latest amendments)

The MRI meeting any other national or international standards which ensure equal or better quality than the standards mentioned above will also be considered but in such cases, a copy of the standard (authenticated English version) should be enclosed with the bid.

Portable / hand-held data collection device (DCD) / Meter Reading Instrument (MRI) will be tailor-made for downloading all data stored in a meter’s memory, and transferring it to the local PC. Each device will at least comprise of the following:

- A lead with optical head for coupling it to the meter
- A lead for plugging it to a personal computer
- An internal battery for powering the device
- A case for safely carrying it about
- A battery charger

The MRI will have a key for starting the data tapping from the coupled meter’s memory, a key to start data transfer to the PC and a display which will indicate the message upon completion of data collection. It will remain “ON” while the date is held in the device, and would go off when all the data has been transferred to the PC. DCD will also have necessary provision for meter clock correction. DCD/MRI will be provided as per the price schedule provided along with the necessary software for communication with the meter as well as the local PC.
Metering Panel (Mounting arrangement for meters)

1.1.1 The meter will be suitable for flush mounting and the same will be suitable for wire-up in a cubicle.

1.1.2 The panel will be of welded construction.

1.1.3 Panels will be completely enclosed and will be dust, moisture and vermin proof to meet the requirements of IP: 51. The panels will be free standing, floor mounting type and will be of rigid, structural frames, enclosed completely, made with specially selected, smooth finished, rolled sheet steel of thickness not less than 2 mm for front, sides, top & bottom portions and the doors. There will be sufficient reinforcement to ensure level surfaces, resistance to vibration, and rigidity during transportation, installation and operation.

1.1.4 All doors and removable covers will be gasketed all around with neoprene gaskets. Ventilating louvers will have screens and filters. Design, material selection and workmanship will be such as to result in neat appearance both inside and outside, with no weld, rivets or bolt heads apparent from outside and with all exterior surfaces true and smooth.

1.1.5 Interior Lighting and Heating:
   a) Each Panel will be provided with lighting fixture rated for 240V A.C. supply, controlled by panel door switch and fuse.
   b) Each Panel will be provided with 240V, 50 Hz, 15Amp 3 pin receptacle and switch.
   c) Each Panel will be provided with one space heater along with its control switch.

1.1.6 Earthing:

Each panel will be provided with earth bus of copper having size not less than 25x3mm securely fixed to (inside) base of panels. As several control panels are to be mounted adjoining each other, the earth bus will be provision to connect earthing to adjoining panel.

All metallic cases and other mounted equipments will be connected to earth bus by copper wires of size not less than 2.5 sq.mm. The colour of insulation for earthing wires will be Green.

1.1.7 Panel internal wiring:

All wiring will be carried out with 660V grade single core multi strand flexible copper conductor wires with P.V.C. insulation and will preferably be flame, vermin and rodent proof. The current carrying capacity of wire will be adequate for the duty assigned to it and will have sufficient flexibility to facilitate proper termination at any location. Colour coded wires (R,Y,B) will be used for CT, VT Secondary connections having size not less than 2.5 sq.mm and auxiliary supply connection having size not less than 1.5 sq. mm.
1.1.8 **Test Terminal Block (TTB)** –

The TTB will be suitable for 3 phase 4 wire, fully enclosed with removable covers and made of moulded, non inflammable plastic material with boxes and barriers moulded integrally. All terminals will be clearly marked with identical numbers or letters to facilitate connection to external wiring. Terminal block will have shorting, disconnecting and testing facilities for CT circuits.